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Zanthoxylum flavum Vahl — Aceitillo, yellow-sanders

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Rutaceae — Rue family

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Zanthoxylum flavum Vahl, commonly known as aceitillo, yellow-sanders, West Indian satinwood, and noyer (*5*), is a medium-sized tree with a straight trunk (fig. 1), very hard bark, a narrow crown, and a small amount of foliage. Its beautiful yellow heartwood has a high oil content and a lasting, fragrant odor of spicy coconut. Because of the commercial value of its wood, the species has been reduced to rare, scattered, individual trees throughout its range.

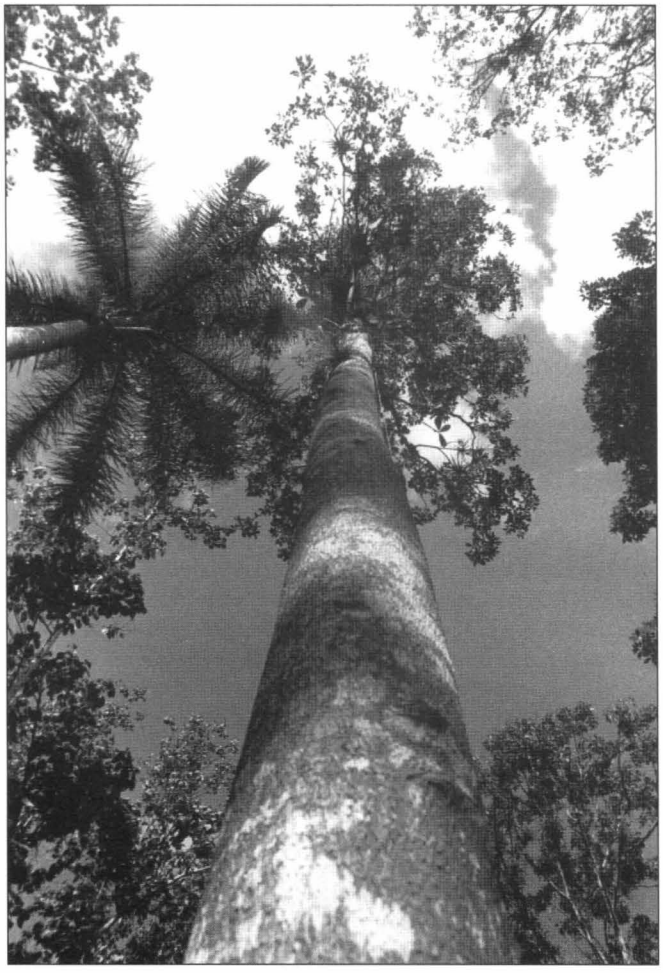

Figure 1.— *Fifty-four-year-old aceitillo (*Zanthoxylum flavum *Vahl) tree growing in a plantation in Puerto Rico.*

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HABITAT

Native Range

The native range (fig. 2) of aceitillo includes Bermuda, the Bahamas, Cuba, Jamaica, Hispaniola, Puerto Rico, Anguilla, St. Martin, St. Barts, Barbuda, Antigua, Guadeloupe, and Marie Galante (*3, 5*). The species is present but very rare on the Florida Keys, except on Key West, where it is no longer found (*4*). It has also been reported in St. Lucia and Bonaire (*5*). Although aceitillo was reported long ago in St. John, U.S. Virgin Islands (*5*), it was not found in a recent survey (*15*).

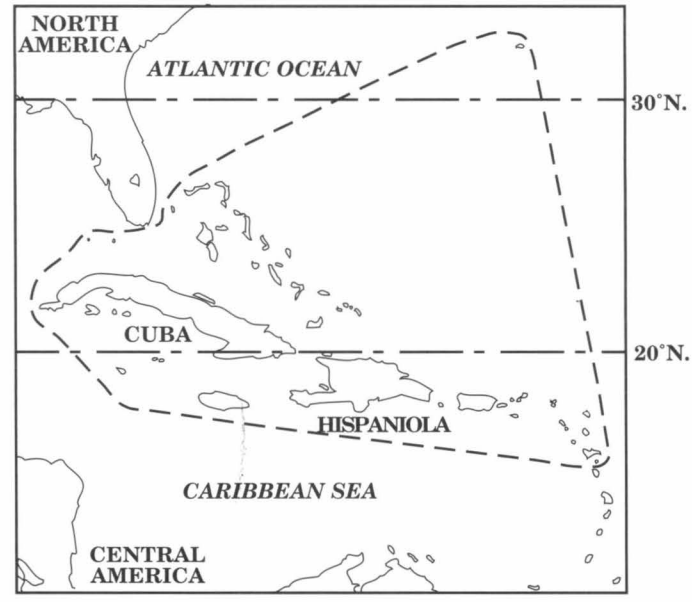

Figure 2.—*The native range of aceitillo (*Zanthoxylum flavum *Vahl) enclosed by a dashed line.*

Climate

Aceitillo tolerates a relatively wide variation in mean annual temperatures, from 21 °C in Bermuda to 27 °C at the southern extent of its range (*12*). However, throughout its range, there is a relatively small variation between summer and winter temperatures. The mean annual rainfall in different parts of the species' range varies from about 850 to 2500 mm/yr, approximately the same as that in Puerto Rico (*1*). However, some portions of its native range receive rainfall fairly well distributed throughout the year while others experience a dry season of up to 2 months. Frost does not occur within its native range.

Soils and Topography

In Puerto Rico, aceitillo grows on soils derived from limestone, serpentine, siltstone, and various types of igneous and volcanic rocks. These soils are usually clays, clay loams, loams, and sandy clay loams with pH's ranging from about 4.5 to about 8.0. Aceitillo is probably able to grow in a variety of soil textures. Although experience from plantations indicates that the species grows well in deep, well-drained, fertile soils, aceitillo in natural forests survives only on rocky ridges and very poor soils because of its slow growth. It has not been reported on poorly drained soils and is presumed to be intolerant of saturated conditions. Trees of the species have been observed growing from near sea level to about 800 m in elevation. All aspects and slopes are suitable habitats for aceitillo.

Associated Forest Cover

Aceitillo can be found in dry subtropical forests on porous limestone in stands dominated by *Bursera simaruba* (L.) Sarg., *Exostema caribaeum* (Jacq.) Schult. in L., *Gymnanthes lucida* Sw., *Pictetia aculeata* (Vahl) Urban, *Pisonia albida* (Heimerl) Britton ex Standl., and *Thouinia striata* Radlk. (*9*). On rocky serpentine ridges in subtropical wet forests in Puerto Rico, aceitillo grows in association with *Clusia clusioides* (Griseb.) D'Arcy, *C. rosea* Jacq., *Coccoloba swartzii* Meissn in DC., *Micronpholis garcinifolia* Pierre, *Neolaugeria resinosa* (Vahl) Nichols., *Podocarpus coriaceus* L.C. Rich, and *Prestoea montana* (R. Graham) Nichols. (author, personal observation). On Barbuda, it was also observed in a plant community dominated by *Canella winterana* (L.) Gaertn., *Guaiacum officinale* L., and *Haematoxylum campechianum* L. that had been highly altered by over-grazing (author, personal observation).

LIFE HISTORY

Reproduction and Early Growth

Flowering and Fruiting.— Aceitillo produces flowers mainly from winter to summer and fruits from spring to fall (*5*). The flowers and fruits are borne on many-branched clusters (panicles) 5 to 12 cm long. Aceitillo is dioecious, bearing male and female flowers on different trees. The fruits are small pods about 6 mm in diameter that split in half when mature to release one shiny, black seed about 3 mm in diameter (*5*).

Seed Production and Dissemination.—Two Puerto Rican seedlots that had been heavily attacked by insects averaged 36,000 and 44,000 seeds per kilogram. Five percent of the seeds in the first lot germinated, beginning 30 days after sowing (*6*). Air-dried seeds from 2 other seedlots collected by the author averaged 66,000 and 47,000 seeds per kilogram. In the first lot, 79 percent of the seeds had been damaged by insects. The second was collected from trees that had been sprayed with insecticide and was free of damage; however, both lots failed to germinate (author, personal observation). Another seedlot collected a few days later from the same sprayed trees germinated at 60 to 70 percent in one nursery and 12 to 20 percent in another; the period from sowing to start of germination was 48 days.[1] An open-grown tree produces fairly large numbers of seeds (estimated at 10,000 to 100,000) per flowering cycle. The dispersion vectors are assumed to be seed-eating birds and bats as with *Z. martinicense* (Lam.) DC. (*2*).

Seedling Development.—Whether for lack of viable seed, lack of suitable natural seedbeds, or competition from other vegetation, seedlings and saplings of aceitillo are very rare in the wild in Puerto Rico (author, personal observation). Seedlings develop slowly, even under nursery conditions. It requires about 1 year to produce 30- to 50-cm seedlings in plastic nursery bags.[1] A total of 277 aceitillo seedlings, planted in the moist limestone hills of northern Puerto Rico, averaged 2.70 m in height at 5 years (author, personal observation). Survival was estimated to range from 60 to 80 percent.

Vegetative Reproduction.— Seedlings, saplings, and trees (at least to pole-size) will sprout when cut. There have been no reported attempts to root or graft cuttings of aceitillo.

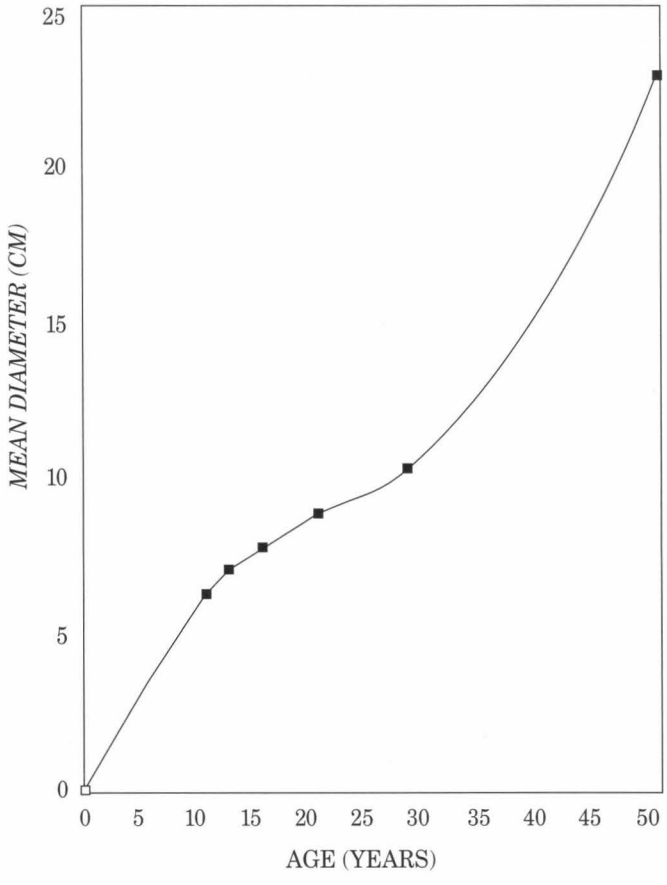

Figure 3.—*Mean diameter growth of dominant and codominant aceitillo (*Zanthoxylum flavum *Vahl) in a plantation in Puerto Rico.*

[1] Rafael Rivera. [n.d.]. Conservation Trust of Puerto Rico, San Juan, PR 00902-4747. Personal communication with author.

Sapling and Pole Stage to Maturity

Growth and Yield.— A small plantation in the Guajataca State Forest, Puerto Rico, was established in 1938, and the trees have been measured for diameter six times since establishment. The results of these measurements reveal a slow diameter growth rate (fig. 3). At 11 years, the plantation contained 68 dominant and codominant trees and averaged 6.6 cm in diameter at breast height (d.b.h.)—a mean annual growth rate of about 0.6 cm (*13*). During the following 40 years, growth averaged about 0.4 cm per year. Of the total of 54 survivors, the mean d.b.h. and height of the 13 dominant and codominant trees were 22.9 cm. and 20.2 cm.[2] Projecting the growth rate of the last four decades to a minimum merchantable size of 25 cm indicates a rotation of at least 60 years. The trees in two other plantations in the same forest, 53 and 54 years old, averaged 17.7 and 16.9 cm in d.b.h. and 21.1 and 16.9 m in height (author, personal observation). These growth rates are probably much greater than those that could be expected in natural stands on very rocky sites.

Aceitillo trees do not grow to be very large. One reference indicates maximum sizes of 50 cm in d.b.h. and 12 m in height (*10*). The largest aceitillo tree known in Puerto Rico measures 37 cm in d.b.h. and 15 m in height.[3] In some habitats, the species grows as a shrub (*10*). Because trees less than 23 cm in d.b.h. have not developed enough heartwood to be of any commercial value, cutting trees with d.b.h.'s less than 25 cm is not recommended (*11*).

Rooting Habit.—New roots are very fine and branch frequently. Within days they thicken and become corky but remain somewhat fragile. Mature aceitillo trees display little or no buttress.

Reaction to Competition.—Because of the relatively slow growth of aceitillo seedlings, new plantations need protection from weeds and brush for 3 to 5 years. The species is relatively short-statured. On fertile sites, it will probably be overtopped by fast-growing, secondary forest species if these are not controlled. Natural stands of aceitillo succeed only on very difficult sites such as rocky ridges with little soil, rocky serpentine soils, and dry forest sites on slopes and ridges where competing trees are sparse and short statured. A total basal area (in stems 5 cm in diameter or greater) of 5.4 m^2 /ha was noted in a subtropical dry forest containing aceitillo (*9*). Basal areas of plots placed in 53- and 54-year-old plantations in Puerto Rico totaled 18.7 and 26.3 m^2/ha including invading secondary forest trees (author, personal observation).

Damaging Agents.—Aceitillo trees usually have excellent form, but old trees may suffer heartrot and catfaces originating from injuries. The seed weevil, *Apion martinizi* Marshall, has a serious ecological effect on the species (*8*) because it destroys a majority of the seeds in most years. The trunk borer, *Leptostylus argentatus* Jacquelin-Duval (Coleoptera), may cause the mortality of some trees, the degrade of logs, and the introduction of heartrot fungus. Other insect species have been collected from aceitillo foliage, trunks, and branches, but apparently do not cause serious damage. Aceitillo wood is resistant to attack by the West Indian drywood termite, *Cryptotermes brevis* (Walker) (*8, 14*). Although untested, aceitillo heartwood appears to be resistant to decay in both buried and exposed positions.

SPECIAL USES

The sapwood of aceitillo varies from nearly white to pale yellow. The heartwood is fine textured with an oily feel and appearance; a beautiful, wavy grain; and a creamy or golden color. When freshly worked, heartwood gives off a strong odor of coconut. A wood sample cut from a dead tree in Barbuda retained its luster, oily texture, and faint coconut odor 6 years after cutting. The author has used shavings of aceitillo wood for potpourri. The resulting fragrance is strong, pleasant, and long-lasting. The heartwood is hard and heavy and has a specific gravity of about 0.90 g/cm^3 (probably air-dried) (*10*). An ovendried sample of heartwood from a tree in Barbuda had a specific gravity of 0.78 g/cm^3 (author, personal observation). Formerly, aceitillo was used to make fine furniture and for cabinetry, inlays, turned items, hand mirrors, and brushes. Using aceitillo roundwood for wood carving has not been very successful because of the tendency of finished pieces to split as they dry out (*11*). The wood was in such high demand for export that the supply was exhausted throughout most of its range around the turn of the century. As late as 1920, stumps and roots of previously cut trees were being collected and exported from Puerto Rico (*5*). The small volume of wood that enters the market today is used for crafts and repairing antique furniture made from the wood of this species.

The seeds of aceitillo probably contribute to the diet of seed-eating birds in areas where the species grows. The flowers attract large numbers of honey bees (*5*, author, personal observation). The species is being used to a limited extent as an ornamental and grows well in the low-quality soils found in yards and street-side strips. Its slow growth rate, moderate size, and dark-green foliage recommend it for planting as an ornamental in urban areas.

GENETICS

Zanthoxylum is a genus of about 300 species in temperate and tropical areas worldwide (*3*). *Zanthoxylum flavum* is also known by the synonym *Fagara flava* (Vahl) Krug & Urban (*3*).

LITERATURE CITED

1. Calvesbert, Robert J. 1970. Climate of Puerto Rico and U.S. Virgin Islands. Climatography of the United States 60-52. Silver Spring, MD: U.S. Department of Commerce, Environmental Science Service Administration, Environmental Data Service. 29 p.

[2] On file with International Institute of Tropical Forestry, U.S. Department of Agriculture, Forest Service, Río Piedras, PR 00928-2500.

[3] Puerto Rican champion tree register. On file with: International Institute of Tropical Forestry, U.S. Department of Agriculture, Forest Service, Río Piedras, PR 00928-2500.

2. Francis, John K. 1991. Zanthoxylum martinicense (Lam.) DC. Espino rubial. Res. Note SO-ITF-SM-42. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 5 p.
3. Howard, Richard A. 1988. Flora of the Lesser Antilles: Leeward and Windward Islands. Vol. 4. Jamaica Plain, MA: Harvard University, Arnold Arboretum. 673 p.
4. Little, Elbert L., Jr. 1979. Checklist of United States trees (native and naturalized). Agric. Handb. 541. Washington, DC: United States Department of Agriculture. 375 p.
5. Little, Elbert L., Jr.; Wadsworth, Frank H. 1964. Common trees of Puerto Rico and the Virgin Islands. Agric. Handb. 249. Washington, DC: U.S. Department of Agriculture. 548 p.
6. Marrero, Jose. 1949. Tree seed data from Puerto Rico. Caribbean Forester. 10: 11-30.
7. Marrero, Jose. 1950. Results of forest planting in the insular forests of Puerto Rico. Caribbean Forester. 11(3): 107-147.
8. Martorell, Luis F. 1975. Annotated food plant catalog of the insects of Puerto Rico. Rio Piedras, PR: Agricultural Experiment Station, University of Puerto Rico. 303 p.
9. Murphy, Peter G.; Lugo, Ariel E. 1986. Structure and biomass of a subtropical dry forest in Puerto Rico. Biotropica. 18(2): 89-96.
10. Record, Samuel J.; Hess, Robert W. 1943. Timbers of the New World. New Haven, CT: Yale University Press. 640 p.
11. Schiffino, Jose. 1945. Riqueza forestal dominicana. Publicaciones de la Secretaria de Estado de Agricultura, Industria y Trabajo. Vol. 1. Trujillo, Dominican Republic: Editora Montalvo. 291 p.
12. Steinhauser, F. 1979. Climatic atlas of North and Central America. Budapest, Hungary: World Meteorological Organization, UNESCO Cartographia. 31 maps.
13. Tropical Forest Experiment Station. 1952. Twelfth annual report. Caribbean Forester. 13(1): 1-21.
14. Wolcott, George N. 1946. A list of woods arranged according to their resistance to the attack of the West Indian dry-wood termite, Cryptotermes brevis (Walker). Caribbean Forester. 7(4): 329-334.
15. Woodbury, Roy; Weaver, Peter L. 1987. The vegetation of St. John and Hassel Island, U.S. Virgin Islands. Res./Resour. Mangt. Rep. SEA-83. Atlanta, GA: U.S. Department of Interior, National Park Service. 101 p.

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